SUMMARY

Reagent materials and associated test elements are provided. In one embodiment, a test element having dual functionality includes a first coenzyme-dependent enzyme or a substrate for the first enzyme, a second coenzyme-dependent enzyme or a substrate for the second enzyme, and a coenzyme selected from the group consisting of thio-NAD, thio-NADP, and a compound according to formula (I) (hereinafter defined). In one embodiment, the first analyte is hydroxybutyrate and the first enzyme is a hydroxybutyrate dehydrogenase, and the second analyte is glucose and the second enzyme is a glucose dehydrogenase or a glucose oxidase. In one aspect, there is provided a test element configured for determining first and second analytes, wherein the first analyte is hydroxybutyrate and the second analyte is glucose, comprising: a first coenzyme-dependent enzyme or a substrate for the first enzyme, wherein the first coenzyme-dependent enzyme is a hydroxybutyrate dehydrogenase; a second coenzyme-dependent enzyme or a substrate for the second enzyme, wherein the second coenzyme-dependent enzyme is a glucose dehydrogenase or a glucose oxidase; and a coenzyme selected from the group consisting of thio-NAD, thio-NADP, carba-NAD and carba-NADP.

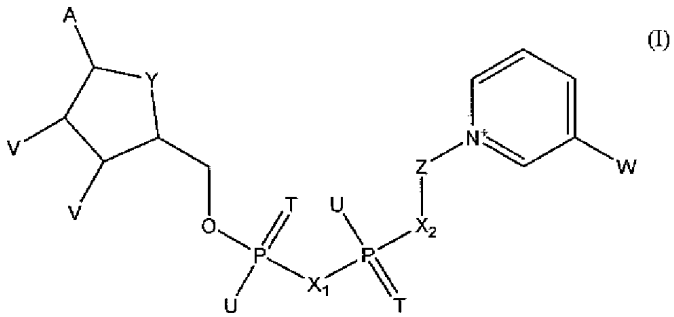
Z = a residue comprising a cyclic group with 5 C atoms which optionally contains a heteroatom selected from O, S and N and optionally one or more substituents, and a residue $CR4_2$ wherein $CR4_2$ is bound to the cyclic group and to X2, and

where R4 = in each case independently denotes H, F, Cl, or CH_3, provided that Z and the pyridine residue are not linked by a glycosidic bond,

or a salt or optionally a reduced form thereof.

In still another further embodiment, the test strip is configured for electrochemical determination of the first and second analytes.

In another aspect, there is provided a method for determining first and second analytes in a sample, wherein the first analyte is hydroxybutyrate and the second analyte is glucose, comprising the steps of: providing a test element as defined herein; contacting the test element with the sample; detecting hydroxybutyrate; and detecting glucose. In yet another embodiment, a method for determining first and second analytes in a sample includes providing a test element configured for determining first and second analytes and that includes a first coenzyme-dependent enzyme or a substrate for the first enzyme, a second coenzyme-dependent enzyme or a substrate for the second enzyme, and a coenzyme selected from the group consisting of thio-NAD, thio-NADP, and a compound according to formula (I):



(I)

in which

A = adenine or an analog thereof,

T = in each case independently denotes O or S,

U = in each case independently denotes OH, SH, BH_3^-, or $BCNH_2^-$,

V = in each case independently denotes OH or a phosphate group,

W = COOR, $CON(R)_2$, COR, or $CSN(R)_2$ in which R in each case independently denotes H or C_1-C_2-alkyl,

X_1, X_2 = in each case independently denote O, CH_2, $CHCH_3$, $C(CH_3)_2$, NH, or NCH_3,

Y = NH, S, O, or CH_2,

Claims

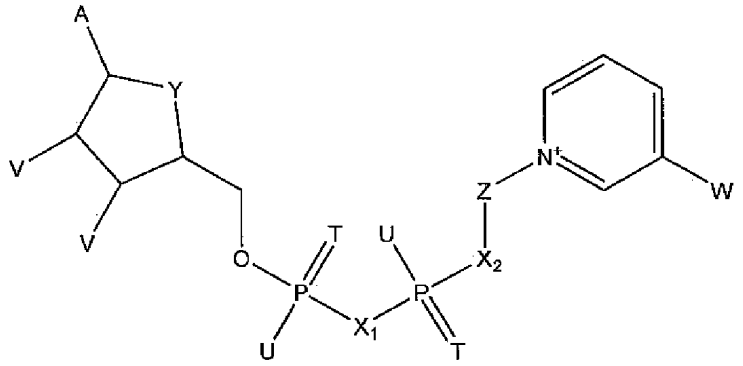
1. A test element configured for determining first and second analytes, wherein the first analyte is hydroxybutyrate and the second analyte is glucose, comprising:

a first coenzyme-dependent enzyme or a substrate for the first enzyme, wherein the first coenzyme-dependent enzyme is a hydroxybutyrate dehydrogenase;

a second coenzyme-dependent enzyme or a substrate for the second enzyme, wherein the second coenzyme-dependent enzyme is a glucose dehydrogenase or a glucose oxidase; and

a coenzyme selected from the group consisting of thio-NAD, thio-NADP, carba-NAD and carba-NADP.

16. The test element of claim 14 or 15, wherein the second reagent material further includes a coenzyme selected from the group consisting of FAD, NAD, NADP, carba-NAD and carba-NADP:



(I)

17. The test element of any of claims 13 to 16, wherein the test strip is configured for electrochemical determination of hydroxybutyrate and glucose.

18. A method for determining first and second analytes in a sample, wherein the first analyte is hydroxybutyrate and the second analyte is glucose, comprising the steps of:

providing a test element according to any of claims claim 1 to 10 or 13 to 17;

contacting the test element with the sample;

detecting hydroxybutyrate; and

detecting glucose.

19. The method of claim 18, wherein the steps of detecting hydroxybutyrate and detecting glucose are performed simultaneously.

20. The method of claim 18 or 19, wherein the steps of detecting hydroxybutyrate and detecting glucose are completed within five seconds after contacting the test element with the sample.

21. A method, comprising:

providing a test element acording to any of the claims 1 to 10 or 13 to 17 configured for determining glucose and ketone values in a sample;

contacting the test element with the sample; and

determining the glucose and ketone values in the sample within 7.5 seconds after contacting the test element with the sample.

22. The method of claim 21, wherein the test element includes a first reagent material for determining the ketone value and a second reagent material for determining the glucose value.

23. The method of claim 22, wherein the first reagent material includes a hydroxybutyrate dehydrogenase.